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## A MOUSE OXYURID, *SYPHACIA OBVELATA*, AS A PARASITE OF MAN\*

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In December, 1918, the late Dr. A. F. Coutant sent me from Zamboanga, Philippine Islands, a sample of fecal material containing tapeworm segments for identification. The sample was from an American Bohemian child living in Zamboanga. She was one of a family of five, all of whom were heavily infested by the worm in question.

Examination of the material showed the presence of eggs and of fragments of the rat tapeworm of man, *Hymenolepis murina* (*H. nana*). This species, until recently regarded as very rare in man, has been found in the course of the hookworm investigations in the South to be fairly common. Indeed, the prophecy made by Dr. Stiles soon after the commencement of that work, that "*Hymenolepis nana* will be found to be the commonest tapeworm in the United States" has been amply justified. Its minute size and the failure of physicians to make routine feces examinations had resulted in its being very largely overlooked, until the intensive studies of the hookworm campaign incidentally brought it to light. Of the more recent statistics there may be cited the studies of Frey (1915), who found this tapeworm in 32.6 per cent. of the inmates of the Texas State Orphans' Home. This percentage was exceeded only by that of hookworm infestation in the same group of 270 children.

While the tapeworm which had attracted attention thus proved to be one already noted in man, the search through the material led to the finding of eggs and two specimens of an Oxyurid hitherto unreported for man. Since the feces sample had been preserved by adding 6 to 10 per cent. formalin solution it is probable that the actual strength of the diluted solution did not exceed 3 to 4 per cent. Thus the fixation of the worms was imperfect, but careful comparison with specimens and with the detailed descriptions by Seurat (1916) have convinced me that the species under consideration is *Syphacia obvelata* (Fig. 1). This nematode has been until recently classed in the genus *Oxyuris*, but more critical work has resulted in its being separated by Seurat as the type of a new genus *Syphacia*. Like the tapeworms

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present in the same sample, it is a species which is known to occur in rats and mice.

#### DESCRIPTION

Both of the worms found in the sample were mature females. Unfortunately, one of the specimens was destroyed in laboratory class work before its value was appreciated. The following description, measurements and figure are from the remaining specimen mounted ventral side up in glycerin jelly.

Female (Fig. 2) elongate-fusiform, measuring 3.7 mm. in length by 0.3 maximum thickness. Cuticula finely cross-striate; two small cervical alae. Mouth surrounded by three broad lips. The body terminates in a long tail which measures from the anus to its tip 0.6 mm. About the anus are fragments of the sepia brown fungous growth noted by von Linstow and by Hall as common on the skin of many females of *Syphacia obvelata*.

The club-shaped oesophagus measures  $300\mu$  in length to the point where it terminates in a subspherical bulb. Bulb  $100\mu$  long. Vulva prominent, situated  $100\mu$  caudad of the oesophageal bulb, or  $500\mu$  from the anterior end. Excretory pore opening behind the oesophageal bulb, about  $250\mu$  in front of the vulva.

Eggs (Figs. 3, 4) are of the typical oxyurid type, asymmetrical, flattened on one side, measuring  $125\mu$  by  $40\mu$ . The embryo is evident in some of the eggs.

#### COMPARISON WITH OXYURIS VERMICULARIS

There is a striking difference in size between specimens of *Syphacia obvelata* and those of *Oxyuris vermicularis*. Our specimens of the former from man measure 3.7 mm. Other specimens of the same species from rodent hosts vary within moderate limits, Hall (1916) giving the range for females as 3.5 to 5.7 mm. On the other hand, females of *Oxyuris vermicularis* range from 9 to 12 mm. in length. The males of *Syphacia obvelata* measure from 1 to 1.6 mm. in length, as compared with 2 to 5 mm. for males of *Oxyuris vermicularis*.

Still more striking are the differences between the eggs of the two species, those of *Syphacia obvelata* (Figs. 3, 4) having over twice the length of those of *O. vermicularis* (Fig. 5), and also being more fusiform. The average measurements for those of *Syphacia obvelata* are  $125\mu$  by  $40\mu$ ; for those of *O. vermicularis*  $52\mu$  by  $24\mu$ . Both are asymmetrical, those of *S. obvelata* being the more strikingly so.

More fundamental differences of structure have led various writers not only to distinguish generically between *Syphacia* and *Oxyuris*, but to remove the well-known human parasite *Oxyuris vermicularis* from

the genus *Oxyuris*. Seurat (1916) established for this species the genus *Fusarella*, but Railliet and Henry (1916) have shown that this must give way to the older name *Enterobius* Leach 1853. Thus the pin-worm of man, almost universally known in the medical literature as *Oxyuris vermicularis*, is more correctly designated *Enterobius vermicularis* (L. 1785) Leach 1853. The type of the genus *Oxyuris* is *Oxyuris equi* (Schrank 1788):

#### INFECTIONS OF MAN BY OXYURIS INCOGNITA

Shortly after this study was begun, there appeared a paper by Kofoid and White (1919) recording the finding of a nematode ovum, apparently undescribed, in 427 cases among approximately 140,000 soldiers examined at Camp Travis, Texas, and of various military units of the Southern Department (Texas, Oklahoma, New Mexico and Arizona).

In as far as there were published data the writers were certainly justified in stating that "this ovum is the largest ovum of intestinal worms encountered in human stools." Their measurements showed its average dimensions as  $95\mu$  by  $40\mu$ , with a ratio of length to diameter of 2.4:1. It is marked by the asymmetry typical of eggs of the Oxyuridae.

"The infected soldiers were examined for most part within two or three weeks after admission from civil life, hence the infection may be attributed to the region of their previous residence. The distribution has been determined on the basis of the place of enlistment of the infected soldiers. In 30,348 examinations made between July 28 and August 21, 1918, there were 361 cases of infection among troops in Camp Travis. These came from forty-eight states of the Union, with infections in twenty-two states."

Though no adult worms were discovered in these examinations, the writers concluded that the eggs are those of an *Oxyuris* to which they tentatively give the name *Oxyuris incognita*.

When Kofoid and White's report first came to my attention I thought it probable that we were dealing with the same parasite. This seemed the more possible, since they state that the egg which they found "is extraordinarily variable in size and proportions, its length ranging from 69 to 133 microns and its diameter from 33 to 43." On more careful examination, however, I found that none of the normal eggs from my specimens were as small as the  $95\mu$  which they give as the average. This was also true of eggs from available specimens of *Syphacia obvelata* from mice. Hall (1916) gives the length of eggs of this species as 110 to  $142\mu$ .

The other common Oxyurid infesting rats and mice in this country is *Oxyuris tetraptera*. The eggs of this species are much smaller than those of *S. obvelata*, averaging about  $90\mu$  in length by  $36\mu$  in width. It is possible that both of these species are capable of development in man, and that the wide variations in measurements obtained by Kofoid and White were due to mixed infections — a very common condition in the rodent hosts. It seems more probable that *Oxyuris incognita* represents a species as yet unknown except in the egg stage.

#### SOURCE OF HUMAN INFESTATION

From the available data relative to the case here reported, it is evident that the food of the child and of others of the family had been grossly contaminated by mice or rats. This accounts for the infestation by one of the commonest nematode parasites of these rodents.

Incidentally, it furnishes circumstantial evidence in favor of the view that *Hymenolepis nana* of man and *Hymenolepis murina* of rodents are one and the same species, as has been claimed, on morphological grounds, by various investigators. Grassi has shown, and we have repeatedly verified in experimental work, that *Hymenolepis murina* is able to complete its development in the intestines of a single host from eggs which have been ingested. The embryos develop in the villi of the intestines and the cysticercoids there produced drop into the lumen of the intestines and develop into the adult worms without the necessity of being transferred to another host.

Thus contamination of food by mice may be the cause of both cestode and nematode infestation of man. Why the nematode infestation is not more common is not clear. The failure to recognize it may be a question of the eggs being less abundant in the feces, or of being subject to marked seasonal variations in appearance, as suggested by Kofoid and White for the species with which they were dealing.

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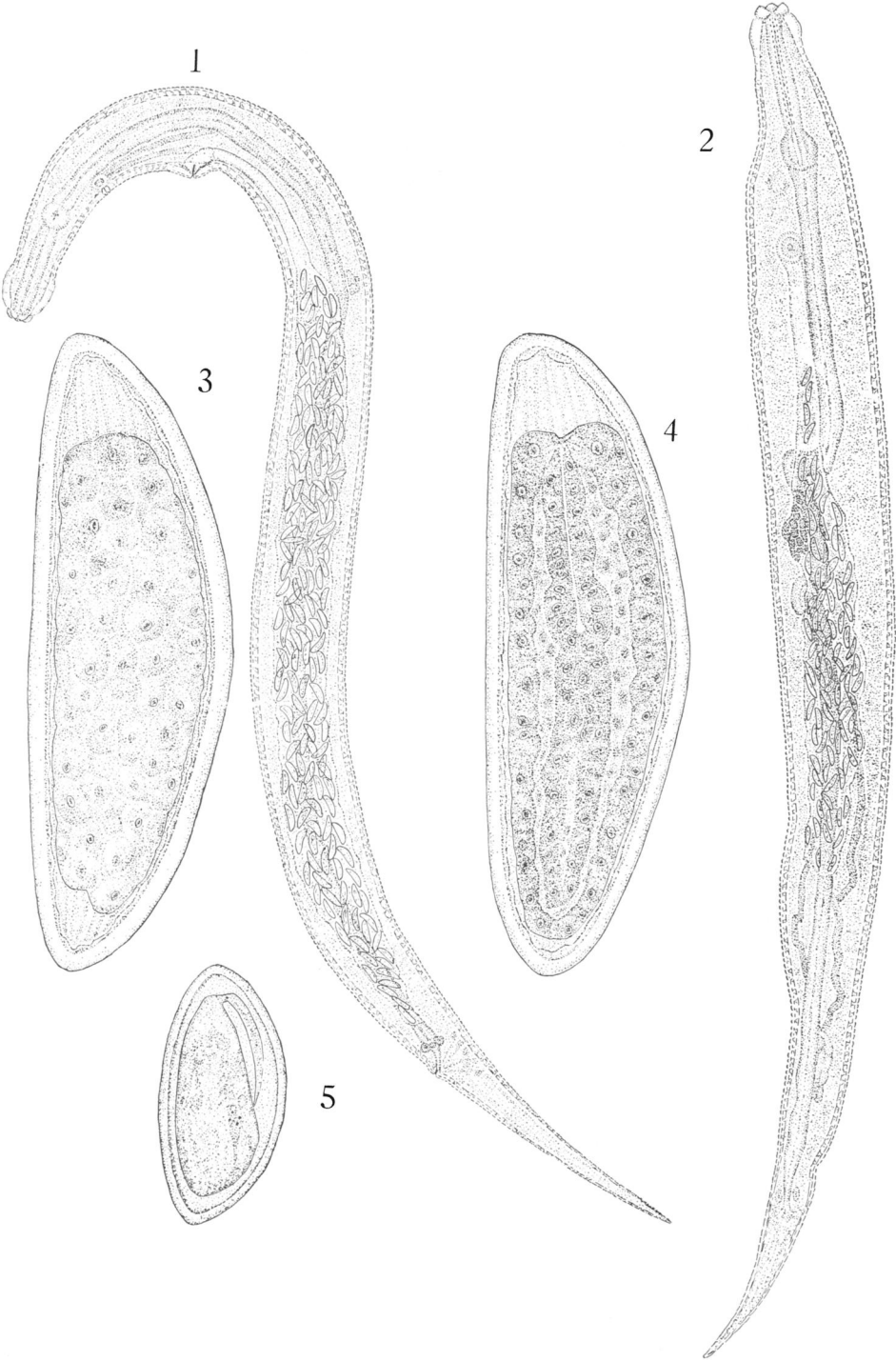


PLATE VII

## EXPLANATION OF PLATE

Fig. 1.—*Syphacia obvelata* (Rudolphi 1802) Seurat 1916, from the cecum of the mouse, *Mus musculus*.  $\times 50$ .

Fig. 2.—*Syphacia obvelata* from a child, Zamboanga, Philippine Islands. The preparation has been unduly compressed, and was twisted at the caudal end.  $\times 50$ .

Figs. 3 and 4.—Eggs of *Syphacia obvelata*.  $\times 720$ .

Fig. 5.—Egg of *Oxyuris vermicularis* drawn to the same scale as Figures 3 and 4.

The drawings were made under direction by G. H. Childs. Figure 5 was redrawn from Braun.